

國立臺灣科技大學 112 學年度碩士班招生試題

系所組別：電機工程系碩士班甲組

科目：電力系統

(總分為 100 分；所有試題務必於答案卷內頁依序作答，否則不予計分)

1. (20%) Define the following keywords.
  - (a) Power flow analysis (5%)
  - (b) Short circuit analysis (5%)
  - (c) Economic dispatch analysis (5%)
  - (d) Stability analysis (5%)
  
2. (20%) For the network shown in Fig. 1, assume no mutual coupling between elements.
  - (a) Form the bus admittance matrix  $Y_{BUS}$ . (15%)
  - (b) Form the bus impedance matrix  $Z_{BUS}$ . (5%)

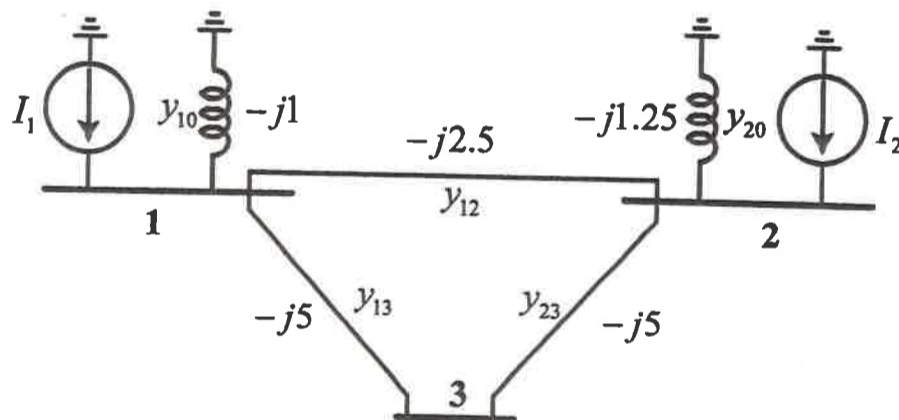


Fig. 1. Single-line diagram for Problem 2.

3. (10%) State the procedure for power flow solution by the Newton-Raphson method.



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4. (10%) A single area consists of two generating units with the following characteristics.

Unit	Rating	Speed regulation R (pu on unit MVA base)
1	400 MVA	4%
2	800 MVA	5%

The units are operating in parallel, sharing 700 MW at the nominal frequency. Unit 1 supplies 200MW and unit 2 supplies 500MW at 60-Hz. The parameter D is the frequency-sensitive load coefficient. The load is increased by 130 MW. Assume that  $D = 0.804$ , find the steady-state frequency deviation.

5. (15%) The one-line diagram of a simple power system is shown in Fig. 2 in which system data is labeled in per unit on a common 100-MVA base. The subscripts 2 and 0 are being used to represent negative and zero-sequence quantities, respectively. The neutral of motor is grounded through a reactor of  $X_n$ . Both the internal voltages of the generator and motor are of  $1.05\angle 0^\circ$  pu before fault. Determine the fault current for the following fault.

- (a) A single-line to-ground fault at bus 2 with zero fault impedance. (10%)  
 (b) A line to-line fault at bus 2 with zero fault impedance. (5%)

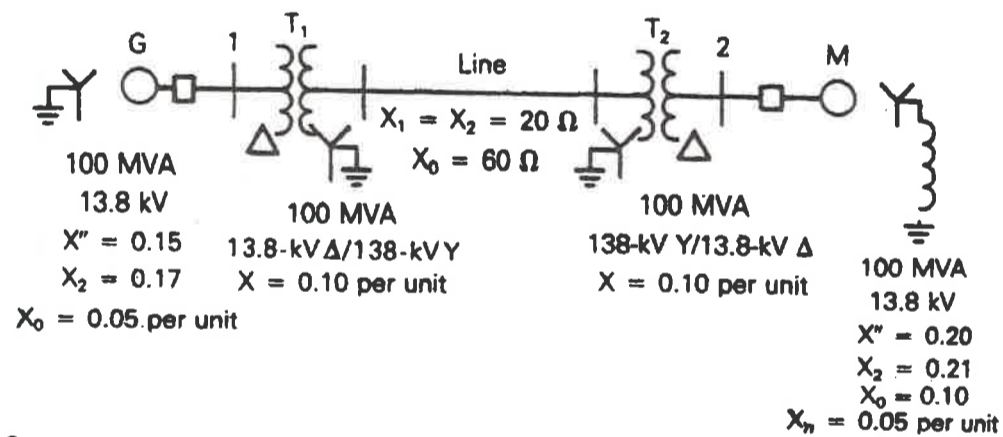


Fig. 2

6. (15%) A three-phase, 60Hz synchronous generator has inertia constant  $H = 6$  MJ/MVA. The power angle equation of the generator power output is formulated as  $P_e = 2 \cdot \sin \delta$  pu, where  $\delta$  is the power angle. Before fault, the the generator power output is 1.0 pu. Assuming the generator power output is zero during fault, determine

- (a) the critical fault clearing angle. (10%)  
 (b) the critical fault clearing time. (5%)

7. (10%) Describe following concepts of power system

- (a) Draw the schematic diagram of LFC and AVR of a synchronous generator including turbine, excitation system, AVR, sensors, LFC, Valve control, etc. (5%)  
 (b) Explain the operating principles of AGC (auto generation control) and tie-line bias control in multi-area power system. (5%)

